International Journal on Smart Material and Mechatronics
IJSMM Vol. 11 No. 1 2024 DOI. 10.20342/IJSMM.11.1.501
p-ISSN: 2356-5314
e-ISSN: 2460-075X

Fire Location Detection Equipment Internet Of Things (IOT) Based

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Abstract **- The main purpose from study This is For make tool detector location fire based on the Internet of Things (IoT) which can inform address in real time and precisely to team extinguisher fire moment incident fire taking place . Study This use method research and development (research and development) developed by Borg & Gall with 4 stages namely : stage analysis , stage planning , stage development and stages testing . Research result tool detector location fire based on the Internet of Things (IoT) can realized with combining sub- systems including ESP32, Ublox Neo-M8N GPS receiver, pushbutton and buzzer. Using phpMyAdmin as the database and website used as location monitoring fire . System has tested and the results tool detector location fire succeed send input signal for send point location fire in a way real time and precisely on the DAMKAR.GO website which is managed by fire operator officers fire . Furthermore, the DAMKAR.GO website was successful displays digital mapping that contains point location incident fire , period nearest hydrant location , send telegram notification on fire extinguisher fires and reporting annually For case fire .**

Keywords **- detector location , fire , extinguishing fire , website, real time, IoT (internet of things).**

I. INTRODUCTION

According to the International Labor Organization fire is something events that are not desired and sometimes No can be controlled , as results burning something material and dispense energy heat and flame . According to the Prevention Agency DKI Jakarta Province Regional Disaster that will occur in 2022 case the fire that occurred as many as 642 cases with total loss not enough more than IDR 130.6 billion . (Kompas.com 01/01/2023).

A number of factor reason fire the most buildings and settlements found among them is connection material burn , current short electricity , equipment House ladder like stove , lamp paste or candles , cigarettes , medicine mosquito burn , burn trash , and flowers fire or firecrackers (Darnita et al., 2021). Reporting This need quite a long time because officer will ensure Name reporter and number telephone giver news , address building or burning objects and functions building or allotment building .

According to service extinguisher fire and rescue , one Standard Operational Procedure Time of incident burned .

One of the points in the SOP is time responsive to announcement until service blackout fire No more than 15 minutes from fire station distance nearest up to 8 km towards location . Besides that tool the installed inside house , which if electricity at home the turn off moment happen fire , then tool the No will works . Therefore That designed A tool with title " Fire Location Detection Equipment Based on the Internet of Things".

Detection tool location fire This designed with using pushbutton as input signal for activate connected device with the website.

II. BASIC THEORY

A. Internet of Things (IoT)

The Internet of Things works through integration device software and devices hard in finish task certain . Device hard come in various form , processor in controlling , sensors collecting information from the physical world , devices connectivity as an intermediary medium communication between device . Whereas device soft role as giver instructions to device hard For operate something function that has programmed . A number of task device software on the Internet of Things such as as managing and presenting data, liaison between device on a system and so on .

B. Arduino IDE

Arduino IDE is abbreviation from the Arduino Integrated Development Environment, namely the integrated software used For create a program and enter it into the Arduino board. Arduino IDE uses Language programming usual self called as Arduino Sketch. Arduino programming language already done change For makes it easier beginner in do programming from Language the original that is C language (Kadir, 2018).

Fig 1. Arduino IDE Display

C. Fire

According to the International Labor Organization fire is something events that are not desired and sometimes No can be controlled , as results burning something material and dispense energy heat and flame . Furthermore according to the National Fire Protection Association fire is A incident oxidation 3 people

p-ISSN: 2356-5314
e-ISSN: 2460-075X

meet elements , ie materials , oxygen , and heat can give rise to material loss or even death man . Every fire can give rise to various type loss like damage tool production , materials production , and losses time Work during the production process

D. Website

The website is designation for group web page (web page), which is generally is part from something domain name (domain name) or subdomain on the World Wide Web (WWW) on the Internet. A web page is written document in HTML (Hyper Text Markup Language) format, which is almost always Can accessed via HTTP, ie conveying protocol information from the website server for is displayed to users via a web browser , either static or dynamic that forms One Suite interconnected buildings related where each is connected with networks page (hyperlink) (Ali Zaki, 2009). Following This application supporter in create a website on the tool detector location fire Internet of Things (IoT) based :

1) XAMPP

XAMPP is device soft free , which supports Lots system operation , is compilation from several programs. Its function is as a standing server itself (localhost), which consists of top programs Apache HTTP Server, MySQL database, and translator written language with Language PHP and Perl programming .

Fig 2. XAMPP display

2) MySQL

According to Wahana Computer (2010:21), MySQL is an open source database server that is quite popular . With various the advantages it has , making this database software Lots used by practitioners For build a project. The existence of the API (Application Programming Interface) facility owned by MySQL makes this possible many kinds of application Written computer with various Language programming can access MySQL database.

3) Visual Studio Code

Visual Studio Code is A A lightweight and powerful text editor created by Microsoft for system multiplatform operation , meaning also available for Linux, Mac, and Windows versions . Features the will Keep going increase along with increase version of Visual Studio Code. Update this version of Visual Studio Code is also done periodically every month , and this is what differentiates VS Code from another text editor.

Fig 3. Views MySQL

Fig 4. Views Visual Studio Code

4) ESP32 NodeMCU

ESP 32 is The microcontroller introduced by Espressif Systems is successor from ESP8266 microcontroller . On the microcontroller This Already available Wi- Fi module in the chip so it is very supportive For make system Internet of Things applications . Seen in figure 5 which is the pin out of the ESP32. The pin can used as input or output for turning on the LCD, lights , even For drives a DC motor. ultrasonic is something functioning components For detect big distance or gauge distance to something object . Ultrasonic sensor is a functioning sensor For change magnitude physical (sound) becomes magnitude electricity and vice versa .

Fig 5. ESP32 Node MCU

5) blox neo-M8N GPS receiver module

Data obtained from the GPS receiver is parsed and converted to longitude and latitude coordinates by the IC ATmega328 microcontroller then combined with real-time time data from the RTC (Real Time Clock) DS1370 and stored in a way continuous to in SD card memory with a capacity of 2 GB. Coordinate data saved geographies later will taken and changed to CSV format so that it can be plotted into in map .

Fig 6. Ublox Neo-M8N GPS Receiver

p-ISSN: 2356-5314
e-ISSN: 2460-075X

III. METHODOLOGY STUDY

Study carried out in the Laboratory of the Electronics Engineering Education Study Program Faculty of Engineering, Jakarta State University. Methods used in research This is Research and Development (R&D) method by Borg and Gall.

A. System Block Diagram

Block diagram system intended For determine sub- systems from the system will made , so can more easy in design and design system to match with plan . Study This aim For For make tool detector location fire based on the Internet of Things (IoT) which can inform address in real time and precisely to team extinguisher fire moment incident fire taking place .

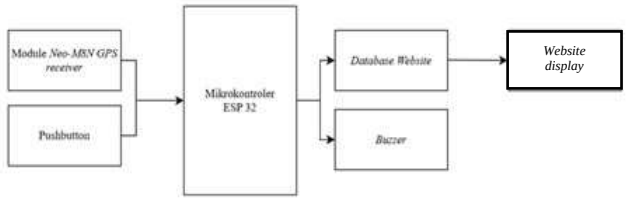


Fig 7. System Block Diagram

B. System Flow Diagram

Flowchart on the designed system started moment tool connected to PLN electricity , then tool be in position active . Next the ESP32 will look for Wi-Fi connection as Internet access . Knob emergency will pressed For activate the GPS module so that it can detect location fire , then location the will appears on the website display .

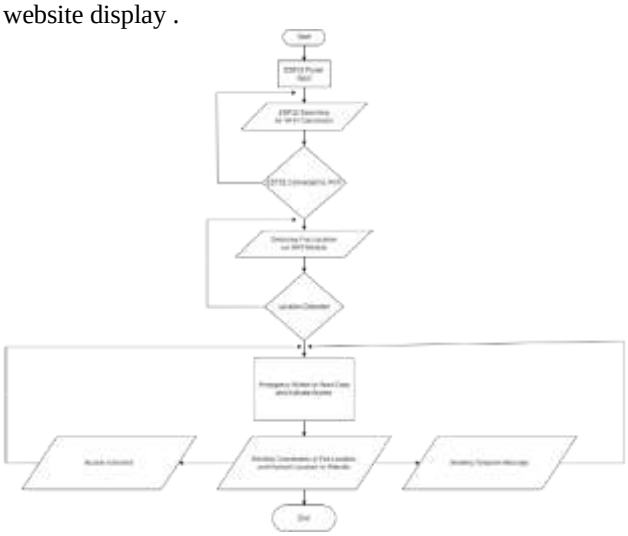


Fig 8. System Flowchart

C. Integration Suite

Circuit schematic used For combine between subsystem to become One unity . Researcher use application maker scheme Suite Deep Fritzing electronics make schema . Scheme for tool detector fire based *The Internet of Things* (IoT) can seen in the picture following .

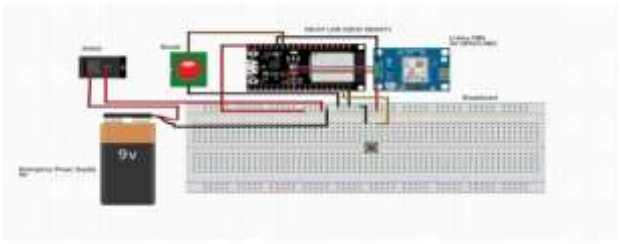


Fig 9. Integration Series Device Hard

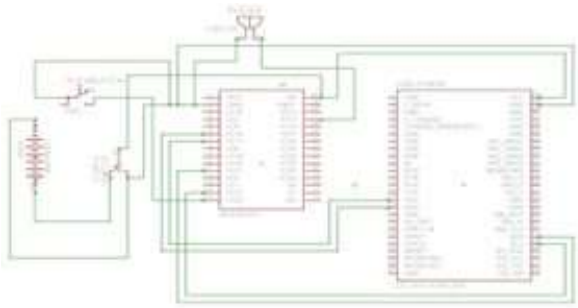


Fig 10. Circuit Schematic Whole

IV. RESULTS AND ANALYSIS

A. Description of Research Results

Based on block diagrams and flow diagrams research that has been made in parts before , then researcher will study results tool detector location fire based on the Internet of Things (IoT). Researcher will do testing based on method that has been discussed in chapter previously . After That researcher will describe results from testing and design from tool the . In Figure 4.1. can seen results design tool looks front , in Figure 4.2. can seen results design tool looks above , in Figure 4.3. can seen results design tool looks side , and in Figure 4.4. can seen results design tool looks in On research has designed website. Following This is display on the existing website designed .

Fig 10. Tool display from Various Sides

p-ISSN: 2356-5314
e-ISSN: 2460-075X

TABLE 1. WESBITE DESIGN

No	Information	Documentation
1	*Home* display on *the Website*	
2	*Dashboard* display on *the Website*	
3	Team view on *the Website*	
4	Monthly *report* display on *the Website*	
5	*Dark mode* display on *the Website*	

B. Discussion and Test Results

Planning system tool detector location fire Internet of Things (IoT) based gain results testing from every the subsystem . Testing done based on criteria specific purpose For state that system that has made succeeded and can Work in accordance with objective research , or failed and didn't can Work in accordance with objective study . Following is criteria testing For research " Fire Location Detection Tools Based on the Internet of Things (IoT)".

1) Testing Source Voltage

Testing source voltage done For know how much big amount Vinput and Voutput will be used as source voltage on the Fire Location Detection Equipment Based *Internet of Things* (IoT). Measurement done with using a digital multimeter and source tested voltage are the adapter and *battery* .

TABLE 2. POWER SUPPLY VOLTAGE SOURCE TESTING 1

No.	Condition	Criteria Testing	Results Testing	Information
1	Input Voltage	5V		5.16V

TABLE 3. POWER SUPPLY VOLTAGE SOURCE TESTING 2

No.	Condition	Criteria Testing	Test result	Information
1	Input Voltage	5V		5.03V

2) Testing Siren (Buzzer) Voltage

TABLE 4. SIRINE (BUZZER) VOLTAGE TESTING

No.	Condition	Criteria Testing	Test result	Information
1	Siren Sounds	3V		3.32V
2	Siren Doesn't Sound	0V		0V

In Table 4.4. is displayed results testing voltage siren . When system turn on siren there is voltage of 3.32 Volt DC which is appropriate with need voltage sirens , so siren can sounds . When system No activate siren , the voltage detected at the siren output of 0 Volt DC, so voltage the in accordance with need siren on the system .

3) Testing Location Detector

Testing done in two ways that is , testing based on tool active that will activated fifty times and do testing detector location based on place that is with compare location original with the location displayed on the website.

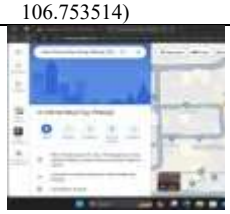
TABLE 5. LOCATION ACCURACY TESTING BASED ON ACTIVE EQUIPMENT

No	Test Address Coordinates	Coordinate Ublox M8N	Difference (m)
1	-6.248924,106.753514	-6.248909,106.7535	2
2	-6.248924,106.753514	-6.248936,106.753538	3
3	-6.248924,106.753514	-6.248936,106.753538	3
4	-6.248924,106.753514	-6.248966,106.753475	6
5	-6.248924,106.753514	-6.248946,106.753444	8
6	-6.248924,106.753514	-6.24892,106.753442	8
7	-6.248924,106.753514	-6.248917,106.753476	4
8	-6.248924,106.753514	-6.248937,106.75348	4
9	-6.248924,106.753514	-6.248947,106.75349	4
10	-6.248924,106.753514	-6.248959,106.753479	6
11	-6.248924,106.753514	-6.248953,106.753474	6
12	-6.248924,106.753514	-6.248952,106.753475	5
13	-6.248924,106.753514	-6.248944,106.753493	3
14	-6.248924,106.753514	-6.248937,106.753509	2
15	-6.248924,106.753514	-6.248948,106.753512	3
16	-6.248924,106.753514	-6.248931,106.753547	4

p-ISSN: 2356-5314
e-ISSN: 2460-075X

17	-6.248924,106.753514	-6.248936,106.753538	3
18	-6.248924,106.753514	-6.248928,106.753557	5
19	-6.248924,106.753514	-6.248941,106.753532	3
20	-6.248924,106.753514	-6.24896,106.753515	4
21	-6.248924,106.753514	-6.248962,106.753514	4
22	-6.248924,106.753514	-6.248985,106.753511	7
23	-6.248924,106.753514	-6.248986,106.753532	7
24	-6.248924,106.753514	-6.248963,106.753515	4
25	-6.248924,106.753514	-6.248962,106.753514	4
26	-6.248924,106.753514	-6.248985,106.753511	7
27	-6.248924,106.753514	-6.248986,106.753532	7
28	-6.248924,106.753514	-6.248956,106.753518	4
29	-6.248924,106.753514	-6.248947,106.753505	3
30	-6.248924,106.753514	-6.248901,106.753527	3
31	-6.248924,106.753514	-6.248878,106.75356	7
32	-6.248924,106.753514	-6.248899,106.753556	5
33	-6.248924,106.753514	-6.248925,106.7535	2
34	-6.248924,106.753514	-6.248917,106.753526	2
35	-6.248924,106.753514	-6.248911,106.753525	2
36	-6.248924,106.753514	-6.248898,106.753505	3
37	-6.248924,106.753514	-6.248934,106.753509	1
38	-6.248924,106.753514	-6.248946,106.753509	3
39	-6.248924,106.753514	-6.248847106.753492	9
40	-6.248924,106.753514	-6.2489106.753521	3
41	-6.248924,106.753514	-6.248926106.75348	4
42	-6.248924,106.753514	-6.248926106.753509	1
43	-6.248924,106.753514	-6.248926106.753509	1
44	-6.248924,106.753514	-6.248926106.753509	1
45	-6.248924,106.753514	-6.248893106.753513	3
46	-6.248924,106.753514	-6.248929106.753564	6
47	-6.248924,106.753514	-6.248922106.753528	2
48	-6.248924,106.753514	-6.248968106.753511	5
49	-6.248924,106.753514	-6.248994106.753537	8
50	-6.248924,106.753514	-6.248979106.753552	7

TABLE 6. LOCATION DETECTION TESTS BASED ON PLACE

No	Test Address	Appearance on *Website*	Difference (m)
1	 Jl. Great Peace Gg. Pelangi 16-8, RT.1/RW.2, Petukangan Sel., Kec . Pesanggrahan , South Jakarta City, Special Region Capital city Jakarta. (-6.248924, 106.753514)	 South Jakarta, Petukangan Sel, Pesanggrahan , South City, Special Region Capital city Jakarta. (-6.248836,106.753)	1 m
2	 Gg. Minah Gani, RT.10/RW.9, Gedong , Kec . Ps. Rebo, East Jakarta City, Special Region Capital city Jakarta. (-6.299403, 106.865494)	 Gg. Minah Gani, RT.10/RW.9, Gedong , Kec . Ps. Rebo, East Jakarta City, Special Region Capital city Jakarta. (-6.299403, 106.865480)	1 m
3	 Jl. R. Mangun Muka Raya No.11, RT.11/RW.14, Rawamangun , Kec . Pulo Gadung , East Jakarta City, Special Region Capital city Jakarta. (-6.193502,106.878390)	 Jl. R. Mangun Muka Raya No.11, RT.11/RW.14, Rawamangun , Kec . Pulo Gadung , East Jakarta City, Special Region Capital Jakarta.(-6.193502,106.878383)	1 m

In Table 4.6 it is shown results testing detector location based on place . When the ublox M8N GPS module detects location and the ESP 32 sends location data On the website, location data is sent own precise and accurate results , so results from Table 4.6 accordingly with need system .

4) Testing Website Connection

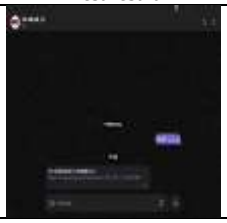
TABLE 7. TESTING WEBSITE CONNECTION

No	Condition	Criteria testing	Test result	Information
1	*Pushbutton* condition *ON*	ESP32 sends point coordinates on *the website*		Succeed
2	*Pushbutton* condition *OFF*	ESP32 does not send point coordinates on *the website*		Succeed

In Table 4.7 it is shown results testing website connection , if the ESP 32 sends point coordinates on the website, then the website will displays point location tool detector location fire placed . Furthermore if ESP 32 does not send point coordinates on the website, then the website does not will displays point location . So that testing website connection , login in indicator succeed .

5) Testing Telegram Connection

TABLE 8. TELEGRAM CONNECTION TESTING

No	Condition	Criteria testing	Test result	Information
1	*Pushbutton* condition *ON*	ESP32 sends point coordinates on telegram		Succeed
2	*Pushbutton* condition *OFF*	ESP32 does not send point coordinates on telegram		Succeed

p-ISSN: 2356-5314
e-ISSN: 2460-075X

6) Testing Fire Location Time Accuracy

Testing This done with method compare time when the pushbutton is pressed For activate tools , arrived with display on the website which includes location fire and location of the nearest hydrant . Indicator success if time No more than 20 seconds .

TABLE 9. TIME ACCURACY TESTING FOR FIRE LOCATIONS

No	*Pushbutton* Active Time	Display Time on Telegram	*Delay*
1			5 seconds

In Table 4.9 it is shown testing accuracy time location fire on *website* . *Delay* distance from *pushbutton* active until display on *the website* is 4 seconds . That matter caused signal network and *refresh* the *website* every 2 seconds . So that testing accuracy time location fire on *website* , log in in indicator succeed .

TABLE 10. TELEGRAM LOCATION TIME ACCURACY TESTING

No	*Pushbutton* Active Time	Display Time on Telegram	*Delay*
1			4 seconds

In Table 4.10 it is shown testing accuracy time location fire on telegram. *Delay* distance from *pushbutton* active until the display on telegram is 4 seconds . That matter caused signal network and *refresh* on telegram every 2 seconds . So that testing accuracy time location fire on telegram, come in in indicator succeed .

V. CONCLUSION

After do testing can concluded that tool detector location fire based on the Internet of Things (IoT) running in accordance with objective study . Result of testing whole tool detector location fire based on the Internet of Things (IoT) , namely can inform point location at the time happen incident fire in a way realtime and precise , with difference error distance is 4.4m with distance nearest is 1m and distance farthest is 9m and accuracy Data delivery is 4 seconds on the DAMKAR.GO website and telegram which is managed by the fire department fire . Furthermore, the DAMKAR.GO website was successful displays event data fire in a way realtime , displays digital mapping that contains point location incident fire , period nearest hydrant location , send telegram notifications with accuracy Data transmission is 4 seconds carry out annual reporting For case fire .

Based on research that has been created and concluded , then researcher have suggestions for the party who wishes develop and expand study This based on the following suggestions :

1. Expected in research Next , you can make applications that can monitor incident fire mobile .
2. Can make tool detector location fire that has signal stable or can used in the room closed .

REFERENCES

[1] Agusri , E., & Kimi, S., "Analysis of Water Needs for Hydrants and Sprinklers at Transmat Mall Palembang," Bearing: Journal Civil Engineering Research and Studies , vol. 5, no. 4, pp. 274–282, 2018.

[2] Arimbawa , IWA, Rahman, AC, & Jatmika, AH, " Implementation of the Internet of Things in Systems Information Tracking Vehicle Motorized Using Web- Based GPS ," Journal Technology Information , Computers and Applications (JTIKA), vol. 1, no. 1, pp. 121–130, 2019.

[3] Bahari, WP, & Sugiharto , A., " Design Build Detection Tools Fire Based on the Internet of Things (IoT)," Eprints.Uty. Ac. Id , vol. 1, pp. 1–9, 2019.

[4] Darnita, Y., Discrise , A., & Toyib , R., "Prototype of Deduction Tool Fire Using Arduino," Journal Informatics Upgris , vol. 7, no. 1, pp. 3–7, 2021.

[5] Dindamkar.bojonegorokab.go.id, " Service SOP Firefighters ," 2018.

[6] Ekotrans , JI, Fire , B., Fire , P., & Regency , K., "JIEE: Implementation Standard Minimum Service (SPM) Management ," vol. 2, no. 1, pp. 55–65, 2022.

[7] Firdaus, F., & Ismail, I., " Comparative Global Position System (GPS) Accuracy of U- blox Neo-6M and U- blox Neo-M8N Receivers in Quadcopter Navigation ," Elektron : Journal Scientific , vol. 12, no. 1, pp. 12–15, 2020.

[8] Hafiz, M., & Candra, O., " Design System Detector Fire Based Microcontroller and Map Application with Using IoT," JTEV (Journal of Electrical and Vocational Engineering), vol. 7, no. 1, p. 53, 2021.

[9] Listyorini , T., & Rahim, R., "A prototype fire detection implemented using the Internet of Things and fuzzy logic," World Transactions on Engineering and Technology Education, vol. 16, no. 1, pp. 42–46, 2018.

[10] Minerva, R., Abyi , B., & Domenico, R., "Towards a definition of the Internet of Things (IoT)," pp. 22–24, 2015.

[11] Önal, A.F., Ülver , B., Durusoy , A., & Erkmen , B., "Intelligent wireless sensor networks for early fire warning systems," Electrica , vol. 20, no. 1, pp. 1–9, 2020.

[12] Sudarta , A., Ferdiansyah , F., Siahaan, RR, & Maruloh , M., " Design Get up Detector IoT- Based Fire and Monitoring with NodeMCU Microcontroller ," Bina Insani ICT Journal, vol. 9, no. 1, p. 22, 2022.

[13] Yusro , M., Guntoro , NA, & Rikawarastuti , "Utilization of Microcontroller Technology Using Arduino Board for Internet of Things (Asystematic Review)," AIP Conference Proceedings, vol. 2331, April 2021.

[14] Wanda, Yulistia , A., & Rusdi , M., " Design Get up Home Fire Early Warning Based on the Internet of Things," Journal Electrical Power Science , vol. 01, no. 1, pp. 36–46, 2020.

p-ISSN: 2356-5314
e-ISSN: 2460-075X

[15] AAA, Raka, “ Fire Location Detection Equipment Based on Internet of Things (IoT)," Thesis Jakarta State University Faculty of Engineering, 2024.